

NOTES ON WEATHER IN OTHER PARTS OF THE WORLD.

Newfoundland.—St. John's, December 28.—A blizzard swept over this island colony to-day and left confusion among communication mediums in its wake. The damage was not extensive, but all shipping was held to ports, train service was disrupted and roads made impassable.—*New York Times*, Dec. 29, 1920.

Capt. Ole B. Bull, whose ship, the *Bergenfjord*, of the Norwegian-American line, arrived here to-day, reported having passed a number of huge icebergs off Cape Race Saturday morning. A heavy snowstorm Saturday night delayed the steamer's arrival eight hours.—*New York Evening World*, Dec. 21, 1920.

Mexico.—Mexico City, Dec. 30.—Mexico City is surrounded by snowclad hills to-day, following the unusually cold weather of the last few days.—*New York Times*, Dec. 31, 1920.

British Isles.—Outstanding features of the weather in the British Isles during December were the wintry spell which occurred during the second week, and the unusual warmth which set in just before Christmas.

* * * The total rainfall for the month in percentages of the average was, England and Wales, 101; Scotland, 91; Ireland, 97.

* * * In London (Camden Square) the mean temperature was 40.7° F. or 0.6° F. above the average.¹

Continental Europe.—[During the first half of December] easterly wind and very cold weather, with falls of snow, were prevalent over many parts of the Continent. In Germany, central Europe, and parts of France maximum temperatures remained below freezing point on several days. * * *

After this period, low-pressure areas moved from Iceland to Scandinavia and pressure remained low in the eastern Atlantic over a very large area until the end of

the month. Temperatures rose generally over western and central Europe, and for the last week of December mild weather predominated on the Continent, except in northern Scandinavia where severe frosts occurred.²

France.—Paris, Dec. 18.—France is suffering from an unusually severe cold wave. Belfort, Bordeaux, and Marseilles report temperatures around 11 degrees above zero, Fahrenheit. Several canals in the Midi district have been frozen over, and snow has caused considerable damage in the region of Nice. In this city the cold has been severe for several days.—*Washington Evening Star*, Dec. 18 (1), 1920.

Brest, Dec. 28.—A storm of utmost violence is raging along the western coast of France. The sea is very heavy, even in the roads of Brest harbor, where a vessel was sunk last night.—*New York Evening Mail*, Dec. 28, 1920.

India.—The winter rain has so far been scanty in India.³

Japan.—Near the middle of the month a heavy storm occurred at the Japanese naval station at Kure, in which 29 vessels laden with iron and coal sank and several heavy guns were plunged into the sea by a landslide.⁴

Australia.—At the beginning of the month beneficial rain fell in New South Wales generally, but in the second week abnormally heavy rain fell over an extensive area around Sydney, doing great damage to the wheat harvest. The storm was the worst that has been experienced in the State for 70 years; 10 inches of rain was recorded in three days, the average December rainfall being 2.6 inches. The rain was particularly disastrous, coming after a three years' drought.

¹ *The Meteorological Magazine*, Jan., 1921, pp. 286-287.

² *ibid*, pp. 287 and 292.

³ *ibid*, p. 292.

DETAILS OF THE WEATHER OF THE MONTH IN THE UNITED STATES.

CYCLONES AND ANTICYCLONES.

By W. P. DAY, Observer.

Cyclones.—The number of LOWS was much above the average. The Alberta type developed numerous secondaries, particularly Colorado lows, which became important storms.

Anticyclones.—High pressure areas were also numerous, the Pacific type predominating.

Tables showing the number of LOWS and HIGHS by types follows:

Lows.

	Al- berta.	North- Pa- cific.	South Pa- cific.	North- ern Rocky Moun- tain.	Colo- rado.	Texas.	East Gulf.	South Atlan- tic.	Cent- ral.	To- tal.
December, 1920....	7.0	1.0	2.0	0.0	6.0	2.0	0.0	2.0	1.0	21.0
Average number, 1892-1912.....	4.3	2.5	0.8	0.3	1.1	2.5	0.2	0.3	0.4	12.4

Higs.

	North Pacific.	South Pacific.	Alberta.	Plateau and Rocky Moun- tain Region.	Hudson Bay.	Total.
December, 1920.....	2.0	6.0	4.0	1.0	3.0	16.0
Average number, 1892-1912....	1.1	1.2	4.7	1.3	0.5	8.8

THE WEATHER ELEMENTS.

By P. C. DAY, Climatologist and Chief of Division.

[Weather Bureau, Washington, D. C., Feb. 1, 1921.]

PRESSURE AND WINDS.

Low pressure over the North Pacific Ocean during December, 1920, favored the entrance into British Columbia and the extreme northwestern portions of the United States of numerous barometric depressions. These usually lost considerable energy on moving inland, and passed eastward, as a rule, along the northern borders of the United States. On the other hand, the high areas frequently entered the United States from the middle Pacific and to the southward of the lows, instead of through the Canadian Northwest, as is usual during a winter month, and pursued their easterly courses south of their normal tracks. As a result of these variations from normal conditions the average pressure for the month was lowest along the Canadian border and highest in the extreme south with a frequent resultant flow of warm air from the south into the more northern districts.

For the month as a whole pressure was below the normal in practically all portions of the United States, and likewise in Canada as far as records disclose. This is an exact reversal of the pressure distribution during the preceding month when the averages were almost wholly above the normal in both countries.

PRINCIPAL STORMS.

On the 1st and 2d a low-pressure area moved from the lower Lakes to New England, increasing greatly in severity as it approached the Atlantic coast, where high winds

prevailed. A second important storm moved from the middle Mississippi Valley during the 4th to 7th attended by general rains, and with high winds from the Great Lakes to New England. Another widespread storm over the central valleys on the morning of the 13th moved to the upper Lakes during the following 24 hours, and developed into a storm of great severity, some unusually low barometer readings being reported, and high winds were general over wide areas.

The last decade had frequent changes in pressure and some of the most widespread storms and cold waves of the month occurred during this period. At the beginning of the decade a storm of wide extent covered the far Southwest and from the 20th to 24th overspread practically all portions of the country from the Rocky Mountains eastward. More or less snow occurred during this period over northern districts, and general rains, heavy in portions of the Gulf States and Ohio Valley, fell to the southward.

From the 26th to 28th an area of low barometric pressure moved from Texas to New England causing general but mostly light snows from the upper Mississippi and lower Ohio Valleys eastward, and moderate to heavy rains over the Gulf and Atlantic Coast States.

The first important high-pressure area of the month approached the middle California coast about the 12th and during the following week drifted slowly eastward over the southern portions of the country. This high area in crossing the Plateau and Rocky Mountain regions brought clear skies and unusual opportunities for night radiation, and the lowest temperatures of the month were recorded over those regions. About the 23d high pressure of the normal winter type moved into the upper Missouri Valley from the British Northwest Provinces and during the following four or five days the coldest weather of the month occurred over nearly all districts from the Rocky Mountains eastward.

The passage of several low-pressure areas across the Great Lakes and their continued movement to the New England coast caused high winds in those regions on the corresponding dates, otherwise there were few damaging storms.

The prevalence of high pressure over the more southern districts favored southerly winds in the Mississippi Valley and Great Plains region as far north as the middle portions of the country. Over other sections east of the Rocky Mountains the winds were mainly from westerly points. In the remaining sections the winds were much diversified.

TEMPERATURE.

During the first half of the month temperature changes were less marked than usual for a winter month and the daily values were mostly above normal, particularly in northern and central districts and over the southern Plains, where the mean temperature for this period averaged from 10 to 15 degrees a day above normal. However, the average temperature for the period was slightly below normal in the east Gulf district and over portions of the lower Mississippi Valley and the far West. Warm weather prevailed in the far Northwest near the middle of the month, but was replaced by considerably cooler weather within the next day or two, and on the 17th killing frosts occurred as far south as central Florida and light frost was observed at Miami. There was a sharp fall in temperature in the middle Atlantic States about the close of the second decade, but moderately warm winter weather prevailed in much of the interior of the

country. The third decade opened with much colder weather in the northern Rocky Mountain region, which soon overspread the central and eastern States, and zero temperature extended well into the central portions of the country. However, about the middle of the decade warmer weather overspread the interior districts, and within the next day or two became general from the Mississippi Valley eastward. In the meantime, it became much colder in the trans-Mississippi States, with zero temperature extending southward to northern Kansas. Toward the latter part of the month much colder weather prevailed from the lower Lake region southwestward, with zero temperature in the central portions of Missouri, Illinois, and Indiana, and the line of freezing extended to the Gulf coast.

For the month as a whole the temperature averages were above normal in all sections of the country except in portions of the Southeast, the central and southern Rocky Mountain districts, and the far Southwest. From the upper Mississippi Valley eastward and in the far Northwest, the month averaged from 3 to 6 degrees a day warmer than normal.

During the first two weeks freezing weather did not extend farther south in the Mississippi Valley than to southern Illinois, and temperatures below zero were not observed except in the mountain regions of the West. The latter half of the month was considerably colder, however, especially in the last decade in the northern districts. The lowest temperature observed during the month, -38° , occurred in Colorado, but temperatures only a few degrees higher were observed generally in the northern tier of States and in the mountains of the West.

The highest temperatures were observed very generally during the first half of the month, although in portions of Idaho, Nevada, and Oregon the warmest days were the last two of the month.

PRECIPITATION.

In the districts from the Mississippi Valley eastward, precipitation was frequent, and similar conditions existed on the Pacific slope from central California northward. In portions of the Rocky Mountains and generally in the Southwest precipitation was infrequent and the amounts generally light.

For the month as a whole precipitation was heavy in the central Gulf States, along the Atlantic coast, and from central California northward. From 6 to 12 inches of rain occurred from Louisiana eastward to Alabama, while somewhat less amounts were received in portions of North Carolina and New England. Precipitation was less than normal in portions of the Ohio, lower Missouri, and upper Mississippi Valleys, and generally in the Rocky Mountain regions and the Southwest.

SNOWFALL.

Snow occurred over the greater part of the country at some period during the month, and east of the Rocky Mountains the total was near the seasonal average in most sections, although the amounts that remained unmelted for any considerable period were usually less than normal. It was less than normal in the Atlantic Coast States from Virginia to Massachusetts and more than normal in northern New York and extreme upper Michigan; 30 inches were recorded at Oswego, N. Y., and 40 inches at Houghton, Mich. In the mountain districts of the West the snowfall was usually less than the normal, although at the end of the month it had accumulated to

considerable depths in the higher elevations of California, Idaho, and eastern Oregon, but in other districts no considerable amounts had been stored.

RELATIVE HUMIDITY.

The moisture in the atmosphere as disclosed by the average relative humidity shows rather discordant conditions when the indications from near-by stations are

compared. No extensive areas had uniformly positive or negative departures from the normal, and large and small departures are frequently shown for stations in close proximity.

In general, the average relative humidity was considerably above normal from the middle Mississippi Valley westward and below to about the same extent in the Gulf States, Appalachian Mountain districts, and in the far Northwest.

STORMS AND WARNINGS—WEATHER AND CROPS.

STORMS AND WEATHER WARNINGS.

Washington Forecast District.—The month was marked by unusual activity in the development and movement of lows across the country and by the absence of Alberta highs until near the end of the month. As a consequence storm warnings were required more than the usual number of times and no cold-wave warnings were issued until the 22d, and there were no general cold wave warnings at all during the month. Seven lows moved across the country with a central pressure of 29.4 inches or lower at the maximum stage of their development and in three of these storms the pressure fell below 29 inches.

During 11 of the first 15 days of the month storm warnings were displayed either on the Great Lakes or the middle or north Atlantic coast. At 3 p. m. of the 1st a disturbance was central over eastern Pennsylvania, moving northeastward and increasing greatly in intensity, and storm warnings were ordered displayed on the New England coast. These warnings were fully verified.

On the morning of the 4th a disturbance, central over Illinois and moving northeastward, was expected to increase considerably in intensity as it advanced over the Lake region, and warnings were displayed at 10 a. m. on the Great Lakes, except on western Lake Superior and the western shore of Lake Michigan. At 8 p. m. the storm was central over Lake Huron with increasing intensity and storm warnings were ordered displayed on the Maine coast. During the night pressure fell decidedly over the northeastern States and a secondary disturbance developed over southern New York. At 9:30 a. m. of the 5th warnings were displayed from Delaware Breakwater northward to Portsmouth, N. H. The warnings on the Atlantic coast were fully verified and those on the Great Lakes were partially verified.

The next storm warnings were ordered at 2 p. m. of the 8th for the Atlantic coast at and between Cape Hatteras and Delaware Breakwater, as a disturbance then central off the southern North Carolina coast was expected to increase in intensity as it moved northeastward. At 9:30 p. m. the warnings were extended northward to Provincetown, Mass., and the following morning to Eastport, Me. These warnings were fully verified, the highest wind velocity reported being 64 miles an hour from the northeast at Cape Henry, Va.

At 8 p. m. of the 12th a disturbance of marked intensity was central over the middle Missouri Valley, moving northeastward and storm warnings were ordered displayed at 10 p. m. on Lake Superior, northern Lake Huron, and on Lake Michigan, except the extreme southern portion. By the following morning this disturbance had split and had two centers, one over eastern Minnesota and the other over Missouri. The latter became the main storm and increased greatly in intensity and during the afternoon and evening of the 13th the warnings were extended to cover all of the Great Lakes. In addition warnings were ordered displayed on the Atlantic coast

from Charleston, S. C., to Eastport, Me., at 10 p. m. This storm increased remarkably in extent and intensity and by the morning of the 14th its central pressure had fallen to 28.60 inches over upper Michigan and gales prevailed generally in middle and northern sections east of the Mississippi River. The winds were controlled by this storm to a great height and a naval balloon which left Rockaway, N. Y., at 12:15 p. m. on the 13th drifted rapidly northward and then north-northwestward to the southern end of James Bay, where it landed at 2 p. m. on the 14th. The center of this storm moved very little during the 14th and 15th and warnings remained displayed on the Great Lakes until the evening of the 15th, when the display of storm warnings for the season terminated. The highest velocities reported were 76 miles an hour from the southwest at Toledo, Ohio, and 72 miles an hour from the south at New York, N. Y. Little damage to shipping was reported as all possible precaution had been taken, due to the timely warnings issued.

On the evening of the 22d a storm of marked intensity was central over Michigan, moving east-northeastward, and storm warnings were ordered for the Atlantic coast from Cape Hatteras to Eastport, Me. On the 23d a velocity of 60 miles an hour from the west was registered at New York, N. Y., which was the only wind of gale force reported on the Atlantic coast. At Buffalo, N. Y., the wind reached a velocity of 96 miles an hour from the southwest, which is the highest ever recorded at that station.

At 10 p. m. of the 26th warnings were ordered displayed on the Atlantic coast from Delaware Breakwater to Eastport, Me., in connection with a disturbance which extended from Michigan southward to the Louisiana coast and with rapidly falling barometer to the eastward. On the 27th warnings were extended southward to Cape Hatteras. Although the pressure continued to fall rapidly no winds of gale force were reported at land stations until the storm center reached the Canadian Maritime Provinces, where gales and heavy snow were general.

Small-craft warnings were displayed on the east Gulf coast from Bay St. Louis, Miss., to Appalachicola, Fla., on the 21st and 26th and were fully justified.

Cold-wave warnings were not required for any part of the Washington district until the 27th, except for Mississippi, western Tennessee, extreme northwestern Florida, and along the Alabama coast on the 22d. On the 27th an extensive area of low pressure was moving rapidly eastward over the region of the Great Lakes and the Eastern States and it was followed by an area of high pressure and abnormally cold weather which had moved from Alberta southeastward to the Plains States. Cold-wave warnings were issued for the Ohio Valley, including all of Ohio, Tennessee, and the East Gulf States, and they were fully verified over most of this area. By the time the cold wave had reached eastern Ohio on the morning of the 28th, the crest of the high-pressure area had advanced to the west Gulf coast and pressure had fallen